Maine Agricultural Experiment Station

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POTATO EXPERIMENTS IN 1903.
NOTES ON THE ANGORA GOAT.
THE PRESERVATION OF HEN MANURE.

This bulletin contains the results of experiments with potatoes in 1903; an account of the Station's experience with the Angora Goat; and experiments upon preventing losses in stored hen dung.

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AGRICULTURAL EXPERIMENT STATION,
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POTATO EXPERIMENTS IN 1903.

CHAS. D. WOODS.

In the season of 1903 five experiments upon the growing, harvesting, and storage of potatoes were undertaken as follows:—

Variety test for resistance to blight.

The effect of Bug Death vs. Paris green on health of vines.

The use of a ready prepared vs. quick lime for the preparation of Bordeaux mixture.

Early vs. late harvesting as affecting the amount of rot.

Storage in large bins vs. small bins, barrels and crates as affecting the development of rot in cellar.

The results of the first four experiments are here reported. The experiment on storage will be finished in April and reported as soon thereafter as practicable.

VARIETY TEST OF POTATOES FOR RESISTANCE TO BLIGHT.

Our observation and experience as well as that of practical growers had indicated a marked difference in different varieties as to their ability to withstand the attack of the fungus which blights the tops and later produces rot in the tubers. It was decided, therefore, to plant a few rows of 10 or 12 varieties, part of each to be sprayed with Bordeaux mixture and part of each to be unsprayed. After consulting some of the large growers in Aroostook County, varieties were selected and planted as follows:—

ARRANGEMENT OF PLOTS IN FIELD.

EAST SIDE OF FIELD.

1	Rose.	Three rows each. Paris green applied as spray to kill the potato bug. No treatment for blight.
2	Early Michigan.	
3	Hulett's Rust Proof.	
4	Mill's Mortgage Lifter.	
5	Green Mountain.	
6	New Queen.	
7	Polaris.	
8	Maggie Murphy.	
9	Irish Cobbler.	
10	Early Ohio.	
11	Gem of Aroostook.	
12	Bovee.	
13	Bovee.	Three rows each. Sprayed with Paris green for the potato bug and with Bordeaux mixture for blight.
14	Gem of Aroostook.	
15	Early Ohio.	
16	Irish Cobbler.	
17	Maggie Murphy.	
18	Polaris.	
19	New Queen.	
20	Green Mountain.	
21	Mill's Mortgage Lifter.	
22	Hulett's Rust Proof.	
23	Early Michigan.	
24	Rose.	

WEST SIDE OF FIELD.

The plot had an area of a little more than an acre. The land had been in grass for several years and for the preceding two seasons had been used as a run for growing chickens. The soil is a rather heavy, fairly uniform loam, with a clay subsoil. It was plowed about seven inches deep in the fall of 1902, and was worked several times in the spring of 1903 with the Clark double action cutaway harrow. Because of the unusual dryness of April and May the turf was not as well rotted and broken up as usual or desirable. The top however was thoroughly pulverized and would in ordinary seasons have proven a good seed bed. The seed was soaked in formaline solution for scab before cutting. About a bushel of each variety were used for seed. The piece was planted about May 12, 1903, six inches deep, with a Robbins potato planter in rows 32 inches apart and 12 inches in the row. A fertilizer carrying 3 per cent nitrogen, 7 per cent available phosphoric acid and 4 per cent potash was applied in the drill at the time of planting, at the rate of 1,000 pounds to the acre. The stand was imperfect but differed greatly with the different varieties, ranging from almost no stand with the New Queen to 2-3 stand with the Irish Cobbler and the Green Mountain. The stand with the different varieties as measured by the number of feet to obtain 55 plants (hills) at time of digging was as follows:—

STAND OF POTATOES BASED ON NUMBER OF FEET OF ROW REQUIRED FOR 55 HILLS AT TIME OF DIGGING.

Variety.	Stand. Per cent of cuttings that produced plants.
Rose	22
Early Michigan	46
Hulett's Rust Proof	37
Mills' Mortgage Lifter	20
Green Mountain	61
New Queen	1
Polaris	55
Maggie Murphy	50
Irish Cobbler	65
Early Ohio	57
Gem of Aroostook	28
Bovee	55

This very poor stand was occasioned largely by the exceptionally dry May and June. In land with proper moisture content the number of cuttings that grew would have been much greater. The differences in the way the different varieties formed plants may have been due to the vitality of the varieties themselves, or to the way in which these particular lots of seed were grown and stored, or to both causes.

The potatoes were cultivated and kept fairly free from weeds. Flat culture was practiced with the result that, owing to the compact nature of the soil, too many tubers were too near the surface and were more or less sunburned.

The east half of the field was sprayed with Paris green at the rate of 1-2 pound to the acre on the following dates: June 19, June 25, July 3, July 13, July 27, August 10. The west half was sprayed six times with Bordeaux mixture and one-half pound of Paris green, one barrel to the acre, on the above dates, and twice with Bordeaux mixture alone on August 21 and August 26.

The experiment was under careful observation during the whole of the growing season. The following extracts from the very full notes which were taken contain the most important observations. The potatoes were all past bloom except as indicated in the notes.

ROSE.

	Unsprayed.*	Sprayed.*
Aug. 21.	Tops dark green. No blight.	Plants small, good color. No blight.
Aug. 26.	Some blight on most plants. Considerable blight on a few plants.	Quite a little blight. More on some plants than others.
Sept. 1.	Leaves on many plants one-third dead.	Leaves on many plants one-fourth dead.
Sept. 8.	Leaves all dead on some plants, one-half dead on others and an occasional plant still quite green.	On most plants leaves half dead. Stalks still good color.
Sept. 10.	Tops as on Sept. 8. Harvested 55 hills. There are apparently two varieties. The dead vines have light rose colored tubers and look like Early Rose. The vines that are still green have much redder and thicker potatoes which are inclined to grow with prongs.	Vines as Sept. 8. Harvested 55 hills. Mixed same as the unsprayed.
Oct. 7.	Tops all dead. Harvested 55 hills.	Tops all dead. Harvested 55 hills.

EARLY MICHIGAN.

	Unsprayed.	Sprayed.
Aug. 21.	A very few spotted leaves on 3 or 4 plants. Does not look like blight. Vines good color.	No blight. Vines small to medium, good color.
Aug. 26.	Considerable blight.	Quite a little blight.
Sept. 1.	Leaves one-half dead with blight.	One half of leaves dead with blight.
Sept. 8.	Vines are from three-fourths to entirely dead.	A few plants still vigorous. Others from three-fourths to entirely dead.
Sept. 10.	Vines as Sept. 8. Harvested 35 hills.	Vines as Sept. 8. Harvested 55 hills.
Oct. 7.	Vines dead. Harvested 55 hills.	Vines dead. Harvested 55 hills.

HULETT'S RUST PROOF.

	Unsprayed.	Sprayed.
Aug. 21.	Strong vigorous vines. Excellent color. No blight.	Good vines. Dark in color. Mostly in bloom. No blight.
Aug. 26.	Vines making good growth. In bloom with many buds not open. No blight.	In full bloom, with still many buds to open. No blight.
Sept. 1.	Still in full bloom and more buds to open. Vines green and vigorous. An occasional spot that resembles blight.	Still in full bloom with some unopened buds. No blight.
Sept. 8.	Tops large and good color. A few buds to open, but for most part nearly through bloom. Very little sign of blight.	Still in full bloom. No signs of blight.
Sept. 10.	Harvested 7 hills. Tubers very unripe. No rot.	Too green to dig.
Sept. 15.	Blight beginning to appear.	No blight.
Sept. 19.	Vines going down with blight.	Very little blight.
Oct. 7.	Harvested 55 hills. Tubers still quite green and stems still green and standing. No rot.	Stems and a few leaves still green. Harvested 55 hills. Tubers quite green. No rot.

* By unsprayed rows are meant plots 1—12 to which Bordeaux mixture was not applied, and sprayed rows mean plots 13—24 which were sprayed seven times with Bordeaux mixture.

MILL'S MORTGAGE LIFTER.

	UNSPRAYED.		SPRAYED.
Aug. 21.	Vines of fair color. No blight.	*Aug.* 21.	Vines healthy. No blight.
Aug. 26.	Some blight on nearly all plants.	*Aug.* 26.	Very little blight.
Sept. 1.	About half of leaves dead with blight.	*Sept.* 1.	About one-third of the leaves dead with blight.
Sept. 8.	Leaves nearly all dead. Stalks dying.	*Sept.* 8.	About one-third of the leaves more or less affected.
Sept. 10.	Tops as Sept. 8. Harvested 55 hills. Tubers unripe.	*Sept.* 10.	Too green to dig.
Oct. 7.	Harvested 55 hills.	*Oct.* 7.	Harvested 55 hills.

GREEN MOUNTAIN.

	UNSPRAYED.		SPRAYED.
Aug. 21.	Very vigorous vines. Possibly some blight.	*Aug.* 21.	Large, dark green vines. Some bloom. No blight.
Aug. 26.	A little blight on most all plants.	*Aug.* 26.	Still some bloom. Very little blight.
Sept. 8.	Leaves one-third dead with blight.	*Sept.* 8.	Very few diseased leaves.
Sept. 10.	Harvested 55 hills. Tubers unripe.	*Sept.* 10.	Too green to dig.
		Sept. 19.	About one-fourth of leaves still green. Stems green.
Oct. 7.	Harvested 55 hills.	*Oct.* 7.	Harvested 55 hills. Stems still quite green.

NEW QUEEN.

	UNSPRAYED.		SPRAYED.
Aug. 21.	Only a few plants. Vines small and a good many of the leaves dead from blight.	*Aug.* 21.	Very poor stand. Small vines. Good color for variety. No blight.
Aug. 26.	Leaves nearly all gone with blight. Stems still green.	*Aug.* 26.	About one-third of leaves dead with blight.
Sept. 1.	Leaves and smaller stems dead. Main stalks still green.	*Sept.* 1.	About one-half of leaves dead.
Sept. 8.	Stalks nearly all dead.	*Sept.* 8.	Leaves all dead.
Sept. 10.	Dug a few hills. Very poor yield. Small and mostly rotten.	*Sept.* 10.	Vines dead. Dug a half dozen hills. About half small and rotten.

POLARIS.

	UNSPRAYED.		SPRAYED.
Aug. 21.	Large vigorous vines of good color. Some bloom. Many leaves affected by blight.	*Aug.* 21.	More than half the plants in bloom. Strong, vigorous vines. No blight.
Aug. 26.	Some bloom. A good deal of blight.	*Aug.* 26.	Some blight. Still in bloom.
Sept. 1.	Leaves one-half dead.	*Sept.* 1.	East row not so good as other two. Very few dead leaves on two west rows. A few plants in bloom.
Sept. 8.	Leaves all dead. Stems dying.	*Sept.* 8.	Leaves about one-third dead. Stalks green and unaffected leaves of good color.
Sept. 10.	Harvested 55 hills.	*Sept.* 10.	Too green to dig.
		Sept. 19.	Vines dead.
Oct. 7.	Harvested 55 hills.	*Oct.* 7.	Harvested 55 hills.

MAGGIE MURPHY.

	Unsprayed.	Sprayed.
Aug. 21.	Quite a number of leaves affected with blight. Plants smaller than Polaris.	Vigorous plants of good color. Quite a number in bloom. No blight.
Aug. 26.	Blight had made considerable progress.	A little blight.
Sept. 1.	One-half of leaves dead.	More blight on west row than other two. East rows one-fifth dead.
Sept. 8.	Leaves all dead. Stems dying.	Leaves about one-third dead. Stalks green. Remaining leaves good color.
Sept. 10.	Harvested 55 hills.	Too green to dig.
Oct. 7.	Harvested 55 hills.	Harvested 55 hills.

IRISH COBBLER.

	Unsprayed.	Sprayed.
Aug. 21.	Plants not very large. Good color except one-third dead with blight.	Fairly large, dark green plants. No blight.
Aug. 26.	A good deal of blight.	Very little blight.
Sept. 1.	Leaves two-thirds dead.	Leaves one-fourth dead.
Sept. 8.	Leaves all dead and stalks nearly so.	Leaves one-half to two-thirds dead. Stems green.
Sept. 10.	Harvested 55 hills.	Stems and one-third to one-half of leaves still green Harvested 55 hills quite unripe tubers.
Oct. 7.	Harvested 55 hills.	Harvested 55 hills.

EARLY OHIO.

	Unsprayed.	Sprayed.
Aug. 21.	Leaves ripening. Some turning from blight.	Pale color as if ripening. Probably no blight.
Aug. 26.	Leaves half blackened. Stems still green. More blight than on any except Queen.	Leaves one-third dead with blight.
Sept. 1.	Leaves and stems dead.	Leaves mostly dead. Stems dying.
Sept. 8.	Harvested 55 hills.	Harvested 55 hills.
Oct. 7.	Harvested 55 hills.	Harvested 55 hills.

GEM OF AROOSTOOK.

	Unsprayed.	Sprayed.
Aug. 21.	Medium sized vines of good color. A few plants have some blight.	Healthy, dark green vines. Many in bloom. No blight.
Aug. 26.	A good deal of blight.	Very little blight.
Sept. 1.	Leaves mostly dead. Stems pale green.	Leaves one-fourth dead.
Sept. 8.	Leaves and stalks dead.	On some plants leaves all dead. On most plants leaves one-third to one-half dead. Stems green.
Sept. 10.	Harvested 55 hills.	Harvested 55 hills.
Oct. 7.	Harvested 55 hills.	Harvested 55 hills.

BOVEE.

Unsprayed.		Sprayed.	
Aug. 21.	Vines small, good color. A few leaves blackened by blight.	*Aug.* 21.	Medium vine. Probably no blight.
Aug. 26.	A good deal of blight.	*Aug.* 26.	Some blight.
Sept. 1.	Leaves all dead. Stems yellowish green.	*Sept.* 1.	Leaves three-fourths dead. Stems dying.
Sept. 8.	Dead.	*Sept.* 8.	Dead.
Sept. 10.	Harvested 55 hills.	*Sept.* 10.	Harvested 55 hills.
Oct. 7.	Harvested 55 hills.	*Oct.* 7.	Harvested 55 hills.

YIELDS OF THE DIFFERENT VARIETIES FROM UNSPRAYED AND SPRAYED PLOTS.

The stand was poor and very uneven, as pointed out on page 183. For this reason the yield from a given area could not be taken as the measure and it was necessary to take the yield from a definite number of hills. This is obviously unfair, since with only half a stand, other things being equal, the yield should be more than half as much as would be obtained with a perfect stand. But as the best stand was only two-thirds of a full number of plants, this can be accepted as a more or less accurate measure of the comparative yields. At the distance apart the potatoes were planted there would be about 16,500 hills to the acre, and 55 hills would represent about 1-300 of an acre and this number of hills was therefore taken as the unit for comparison.

In order to compare the early and late digging upon the amount of rot, 55 hills of all varieties that were ripe or nearly ripe enough for digging, were harvested on September 8. A month later (October 7) 55 hills of all the varieties were harvested. The yields at time of digging are given in the table which follows. The Rose was made up of two varieties, one early and one late, and is omitted. The Queen is also omitted because of its poor stand (1 per cent).

YIELDS FROM FIFTY-FIVE HILLS OF TEN VARIETIES POTATOES AT TIME OF DIGGING.

Variety.	Date of harvesting.	Unsprayed.			Sprayed.		
		Good—lbs.	Rotten—lbs.	Small—lbs.	Good—lbs.	Rotten—lbs.	Small—lbs.
Early Michigan	Sept. 8	55	19	4	78	3	7
	Oct. 7	52	21	7	78	1	7
Average		54	20	6	78	2	7
Bovee	Sept. 8	45	33	6	60	12	8
	Oct. 7	59	28	5	57	11	7
Average		52	31	6	59	12	–
Early Ohio	Sept. 8	18	40	5	49	22	6
	Oct. 7	32	38	3	68	16	8
Average		25	39	4	59	19	7
Gem of Aroostook	Sept. 8	46	24	5	71	20	9
	Oct. 7	74	36	5	72	13	5
Average		60	30	5	72	17	7
Irish Cobbler	Sept. 8	95	20	9	111	12	5
	Oct. 7	66	13	7	107	6	6
Average		81	17	8	109	9	6
Hulett's Rust Proof	Sept. 8						
	Oct. 7	81	1	7	99		6
Mill's Mortgage Lifter	Sept. 8	68	24	4			
	Oct. 7	82	25	5	82		3
Average		75	25	5	82		3
Green Mountain	Sept. 8	68	37	4			
	Oct. 7	84	18	5	153	11	4
Average		76	28	5			
Polaris	Sept. 8	63	40	5			
	Oct. 7	59	41	6	105	20	7
Average		61	41	5			
Maggie Murphy	Sept. 8	55	28	2			
	Oct. 7	51	52	2	87	14	2
Average		53	40	2			
Average of 5 earlier varieties	Sept. 8	52	27	5	74	13	7
	Oct. 7	57	27	5	76	10	7
Average of 5 later varieties	Sept. 8	54	27	5	75	11	7
	Oct. 7	71	27	5	104	9	6

SUMMARY OF RESULTS.

There is a marked difference in the blight resistant properties of the different varieties. As a rule the earlier varieties were soonest attacked.

Because of the uneven stand only very general conclusions can be drawn from the yield.

With the exception of the Bovee, harvested October 7, the yield was sufficiently increased to more than equal the cost of

spraying. On the average, the yield of the earlier varieties was one-third greater from the sprayed rows and in the case of the late varieties one-half greater.

The yield of merchantable potatoes from the early varieties was practically the same, whether dug in September or October. The yield of the late varieties, both sprayed and unsprayed, was a third greater at the later date.

It is planned to continue this experiment in the season of 1904.

Bug Death vs. Paris Green on Yield of Potatoes.

Pine Cone vs. Lump Lime for Bordeaux Mixture.

A four acre field on the college farm of fairly uniform soil was prepared and planted to potatoes. The soil is a medium heavy loam with a heavy clay subsoil. The field had been in grass since 1898 until it was plowed in the fall of 1901. In 1902 it was quite heavily dressed with barn manure and planted to silage corn. About 600 pounds per acre of a high grade commercial fertilizer was applied in drill at time of planting the corn. The yield of silage corn was about 14 tons to the acre. Because of the backward season the ears were not filled when the corn was harvested. The land was plowed in the fall of 1902, thoroughly worked with the Clark double action cutaway harrow in the spring of 1903, and ten days before planting was cross plowed and reworked with the cutaway harrow, so that at time of planting an excellent seed bed had been prepared. May 14 and 15 the field was planted with Aroostook County grown Green Mountain potatoes, with the Robbins planter, about 6 inches deep, in rows 32 inches apart and 12 inches in the row. About 1000 pounds per acre of a fertilizer carrying 3 per cent nitrogen, 7 per cent available phosphoric acid and 4 per cent potash was applied in the row by the planter. During the season the field was kept cultivated and fairly free from weeds. The potatoes were all sprayed seven times, June 19, June 25, July 3, July 13, July 17, Aug. 13, and Aug. 19. Part of the field was sprayed with Bordeaux mixture and Bug Death at the rate of a barrel of Bordeaux and 25 pounds of Bug Death per acre to each application. A second part was sprayed with a barrel of Bordeaux mixture and a half pound of Paris green for each application, except that on July 13 the Paris green was used at the rate of

a pound to the acre and no poisons were used Aug. 19. A third part of the field was sprayed the same as the second, except that the Bordeaux mixture was made by using 5 pounds of prepared Pine Cone Lime in place of that weight of lump lime. At harvesting each part of the field was dug by the Hoover potato digger. The potatoes were assorted in the field, put into sacks and taken to the barn and weighed. The crop for each part of the field was handled by itself. The stand was fairly uniform over the whole field and for the season a very good one, about 80 per cent of a perfect stand. The condensed field notes follow and in the tables beyond are given yields from the different parts of the field and the yield calculated per acre.

CONDENSED FIELD NOTES.

Bordeaux Mixture and Bug Death Part of Field.		Bordeaux Mixture and Paris Green Part of Field.		Bordeaux Mixture from Prepared Lime and Paris Green Part of Field.	
Aug. 21.	Vines beginning to turn yellow. Some blight. The east rows not so good color as the west rows. Very little indication of work of potato bugs.	*Aug. 21.*	Vines better color than on Bug Death portion. Very little if any evidence of blight. Tops not damaged by bugs but eaten rather more than on Bug Death part.	*Aug. 21.*	The notes agree with those taken for the part treated with regular Bordeaux and Paris green.
Aug. 26.	Whole of this part yellowing very badly. Quite a little blight.	*Aug. 26.*	Vines not so yellow as where Bug Death was used but blight about the same	*Aug. 26.*	Vines appear about the same as where regular Bordeaux was used.
Sept. 1.	Leaves one-third dead and the rest yellowing.	*Sept. 1.*	Leaves rather better than on Bug Death part.	*Sept. 1.*	Leaves about the same as on regular Bordeaux part.
Sept. 8.	Leaves three-fourths to wholly dead. Stems green but some quite pale.	*Sept. 8.*	Leaves and stems about the same as on Bug Death part.	*Sept. 8.*	Leaves and stems about the same as on other parts.

As the potatoes in the north end of the Bug Death part of the field were rotting considerably, and as there was a market for them for immediate use, it was decided to harvest the northern part of the field September 15. The remainder were harvested September 29, 1903. The table which follows shows the area of the plots, the yield per plot in pounds and the calculated yields per acre.

YIELD OF POTATOES FROM A FIELD TREATED WITH BORDEAUX MIXTURE AND BUG DEATH, REGULAR BORDEAX AND PARIS GREEN, AND BORDEAUX MIXTURE MADE FROM PINE CONE, PREPARED LIME AND PARIS GREEN.

Treatment of Tops.	Date of harvest.	Area of plot.	Yield of Potatoes.			
			Total.	Merchantable.	Rotten.	Small.
Yields Per Plot in Pounds.		Acres.	Bush.	Pounds.	Pounds.	Pounds.
Bordeaux mixture and Bug Death	September 15.	.35	....	4,810	820	500
	September 29.	.35	....	6,200	440	680
Total		.70	....	11,010	1,260	1,180
Regular Bordeaux and Paris green	September 15.	.37	.....	5,400	500	440
	September 29.	.88	.....	10,340	1,480	720
Total		.95	.....	15,740	1,980	1,160
Bordeaux from prepared lime and Paris green	September 15.	.43	.....	6,870	810	400
	September 29.	.61	.....	9,310	700	600
Total		1.04	.....	16,180	1,510	1,030
Calculated Yields Per Acre in Bushels.				Bushels.	Bushels.	Bushels.
Bordeaux mixture and Bug Death	September 15.	.....	292	229	39	24
	September 29.	.....	348	295	21	32
Average*		.....	320	262	30	28
Regular Bordeaux and Paris green	September 15.	.....	288	243	23	20
	September 29.	.....	360	297	42	21
Average*		.....	332	276	35	21
Bordeaux from prepared lime and Paris green	September 15.	.... ..	314	266	31	17
	September 29.	.....	290	254	19	17
Average*		... .	300	259	24	17

*The average was obtained from total yield of plots which takes into acconnt the relative size of the parts harvested at different dates.

The yields were like nearly all potato yield in the season of 1903, good, ranging from about 230 to 300 bushels of merchantable potatoes. The yield was heavier on the southeast and northeast sections of the field than in the two other quarters. Whether this was due to a difference in the soil, is not clear. If the field had been harvested on one date, these differences would not have appeared, as the average yield from the three parts of the field differently sprayed ranged from 259 to 276 bushels of merchantable potatoes,—or no greater difference than must always be expected from unassignable causes. As in the experiments of last year* the use of 25 pounds of Bug Death

*See bulletin 87 of this Station.

per acre at each application effectually protected the potatoes from the ravages of the Colorado potato beetle. From its use, however, no larger crops were obtained than where Paris green was used as the poison. Desirable as it would be to find some method of controlling the potato beetle without the use of poison, there seems to be no immediate prospect of its attainment. As good crops, both as measured by total yield and starch content, can be obtained by the use of Paris green as an insecticide as by anything yet suggested as its substitute. Used in moderate amount, one-half to one pound per acre, in connection with Bordeaux mixture, there is no trustworthy evidence that the potato, as measured by growth of vines and yield of tubers and of dry matter, is injured by the use of Paris green.

The ready prepared lime was more convenient to use than the ordinary lump lime. The prepared lime does not carry as much lime per pound as pure lump lime. Since lump lime always carries more or less of impurities (sand, etc.) which are largely removed in the manufacture of the prepared lime, 5 pounds of the prepared lime is sufficient to use with 5 pounds of copper sulphate in the preparation of Bordeaux mixture. In this trial Bordeaux mixture made by the use of prepared lime was as effective against blight as that prepared in the usual way. The prepared lime costs more per pound than the lump lime but its use saves time, and hence may not in the end prove more expensive.

NOTES ON THE ANGORA GOAT.

CHAS. D. WOODS.

The Angora goat was first introduced into this country in 1849 and by the close of the century there were many thousands in the West and Southwest. At the beginning of the present century wide spread interest in these animals was aroused all over the country, and they are now to be found in every state of the Union. The original importations of Angora goats were from the province of Angora in Turkey. Because of heavy European demand for mohair, the Turkish growers "without wise forethought began the practice of crossing the Angora upon the common Kurd goat * * * * This fact coupled with the belief that proper care was not exercised in selecting the animals exported to this country and that they have been carelessly bred here has led some excellent judges of Angoras to express the belief that there are really no pure bred Angora goats in the United States."*

The two publications of the U. S. Department of Agriculture named in the notes at the foot of this page are enthusiastic over the possibilities of Angora goat farming, and the following paragraph on "The uses of Angora goats" is quoted from these bulletins.

"Investigations prove that the Angora goats are not only classed among the most useful of the domestic animals, and have been so classed for thousands of years, but their usefulness is manifested in a variety of ways. The fleece, called "mohair," furnishes some of the finest fabrics among ladies' goods and is used in various other manufacturies; their habit of browsing

NOTE.—Farmers' Bulletin 137 of the United States Department of Agriculture on the Angora Goat can be obtained free by applying to Congressmen, or to the Secretary of Agriculture, Washington, D. C.

* The Angora Goat, Bulletin 27, Bureau of Animal Industry, U. S. Dept. of Agriculture.

enables the farmer in a wooded localty to use them to help in subjugating the forest; their flesh is exceedingly delicate and nutritious; the milk, though not so abundant as with the milch breed of goats, is richer than cow's milk; their tanned skins, though inferior in quality to the skins of the common goat, are used for leather; their pelts make the neatest of rugs and robes; they are excellent pets for children; a few of them in a flock of sheep are a protection from wolves and dogs; their manure is noticeably helpful to the grass which follows them after they have cleaned away the underbrush."

The claims made for their browsing habits as a help to clearing wooded areas and particularly "sprout land" especially attracted the attention of this Station. Mr. Libbey of Burnham during 1900 and 1901 imported into Maine from Texas and New Mexico several hundred Angoras, from which number the Station purchased in 1901 six does and a "registered" buck, not akin to the does.

The buck bought by us has the Angora type and is probably at least fifteen-sixteenths Angora. The does are grade and apparently differ in their purity of breeding.

During the winter months the goats have been kept in a room in the sheep house with the run of a yard. In the summer they have been kept in woodland and in pasture growing up to bushes and in young woodland. In the barn the only feed has been hay, and no supplementary food was given when in pasture. This care was not sufficient in this case to successfully build up the flock. In the spring of 1902 five of the does dropped one kid each and in the spring of 1903 only two of the does produced offspring. The flock at the end of two years would thus have only doubled or increased from 7 to 14. The kids were vigorous when dropped and presented no difficulties in rearing, but at the end of 18 months they were not as large as their dams. One of the wethers was killed to test its flesh and one of the does died before it was a year old, so that we had the same number or 12 in the pasture during the seasons of 1902 and 1903. When fed on hay, the goats ate on an average 4 pounds per day. In the summer of 1901 the goats were put in a pasture with some bushes and weeds. The goats ate these in preference to the grasses.

The pasture was fenced with ordinary woven wire fencing, and the goats persisted in putting their heads through the meshes and

were imprisoned by their V-shaped horns. The fence posts were braced at the end of each length of fencing, and the goats would walk up the braces and jump down on the other side of the fence. In our experience, the goats will climb any kind of a rail fence with angles, but will not jump over a fence they cannot climb. Because of the difficulties experienced in fencing, but little was learned the first of the season of their work in clearing up land.

The second season an acre of young woodland containing bushes and trees of mixed growth, from sprouts up to 6 or 7 inches in diameter, was inclosed with Elwood poultry fence (not poultry wire netting) 58 inches high. By taking care to have no braces on the inside of the fence and no spaces under it through which they could get their heads, this made a fence that would not only keep the goats in, but would also keep dogs out. In this inclosure, with a lean-to shed for them to run into in bad weather and at night, they demanded no care during the summer other than an occasional salting. In a pasture without water this would have to be provided, although they are small drinkers. They will stand low temperatures, but wet is not to their liking. With a protection open to them, there is no danger of their getting wet, as at the sound of the first sprinkling on the foliage they will all leave off feeding and make a break for shelter. In 1903 another half acre was added to this run for them. There was a quite thick growth of underbrush in the lot. The small underbrush of birch, maple, hazelbush, etc., has been cleaned up so that where there are no alders or evergreens the ground under the trees is as clean as though it had been burned over. Sweet fern they do not like very well, but they have cleaned all of the hardhack out of this piece. Ferns and brakes have been eaten to some extent. They have eaten the leaves and young sprigs of bushes in preference to grass. Birches two inches or more in diameter they have not injured, but they have stripped the bark from every maple. Even maple trees six inches in diameter have been thus killed. We have found them to be fond of the bark of apple trees, even eating the bark from old trees. The illustrations on page 196 show the appearance of the wood lot in the spring of 1902, while on page 197 are views from the same portion taken in the late summer of 1903.

TWO VIEWS SHOWING CONDITION OF OVERGROWN PASTURE IN JUNE, 1902. THIS LAND HAD NOT BEEN IN PASTURE FOR FIFTEEN YEARS.

TWO VIEWS OF THE PASTURE SHOWN ON THE OPPOSITE PAGE SHOWING THE EFFECT OF TWO SEASONS' PASTURAGE WITH ANGORA GOATS.

The fleeces averaged about three pounds each and sold for only a small advance above wool. With nearer pure bred grades and a larger number, so as to have more mohair to market, a better price would be obtained.

Our experience may be summed up as follows:—

It is practically impossible, for a moderate price, to obtain pure bred Angora goats.

They are quite hardy and thrifty and can be kept with the same winter care that sheep demand.

It requires about 750 pounds of hay to winter one goat. With plenty of young woodland or brushy pasture there will be no food cost in summering them.

They are effective in clearing up the underbrush in woodland covered with birch or evergreen. They will likely kill other varieties except very large trees. They will clear out bushes and waste growth in pastures, in preference even to the grasses.

Ordinary fencing will not hold them. A fine mesh wire fence of such height that they cannot rest the front feet upon it will hold them, even in small areas. They do not jump, but are good climbers.

The flesh has a flavor between that of lamb and venison. The carcasses are small and there is no market in the East for the flesh.

The mohair from the crosses brings a somewhat higher price than wool. Three pounds per animal is about all that can be expected from seven-eighths bred goats.

They are very docile and intelligent and make excellent pets. Their bush-eating proclivities would make them a nuisance among decorative shrubbery.

THE PRESERVATION OF HEN MANURE.

CHAS. D. WOODS AND J. M. BARTLETT.

The dung of fowls contains, in addition to the undigested residue from the food, the excrements of the kidneys, and is therefore much more nitrogenous than that of other domestic animals. Most of the nitrogen of the dung is in the form of uric acid and is very readily available to growing plants. It is however very quickly changed into carbonate of ammonia by putrefaction, and as hen dung is ordinarily stored much of the nitrogenous matters go off into the air as ammonia gas and is lost. The remarkable fertilizing value of guano derived from the dung of sea birds is due to the urates which it carries. Weight for weight, the droppings of the hen roost are not nearly as valuable as guano, but are of much greater value than ordinary barn manure.

While there are quite a number of European and a few American analyses of hen manure, the writers failed to find other studies upon hen dung and its use. Indeed the three pages devoted by Storer* to the dung appear to sum up about all the literature on the subject.

COMPOSITION OF HEN MANURE.

The table which follows contains all the trustworthy American analyses of fresh hen manure that the writers have found. Other analyses in which plaster in unknown amounts had been mixed with the droppings, and of dried hen manure have been reported.

The percentage of water in these samples was from 50 to 60 per cent. In all of them there had doubtless been a loss of nitrogen in the drying of the samples before analysis. The loss in the case of the samples analyzed at the New York Station was estimated at 43 per cent. A sample of fresh dung from the

* Agriculture, in some of its relations with chemistry, F. H. Storer, Chas. Scribner's Sons, New York, 1899, Vol. 1, p. 612.

same pen as Nos. 2 and 3 was found to carry 1.28 per cent of nitrogen.

The composition of the dung would vary with the food fed. According to the N. Y. Station analyses, "the manure from the fattening fowls was more valuable than from those which were laying, mostly from the larger content of nitrogen."

FERTILIZING CONSTITUENTS OF FRESH HEN MANURE. ANALYSES MADE AT AMERICAN EXPERIMENT STATIONS.

Reference number.	Source of analyses.	Weight per year.	Fertilizing Constituents.		
			Nitrogen.	Phosphoric acid.	Potash.
		Pounds.	Per cent.	Per cent.	Per cent.
1	New Jersey Station Bulletin 84....	....	1.15	.92	.45
2	New York Station Report 1889. ...	33	.81	.92	.32
3	New York Station Report	29	.66	.82	.25
4	New York Station Report (capons)	43	1.24	.93	.36
5	Mass. State Station Report 1886....	.....	.79	.47	.18
6	Mass. State Station Report 1890...	....	1.20	1.00	.32

EXPERIMENTS IN STORING HEN DUNG TO PREVENT LOSS OF NITROGEN.

It has been a common practice for writers to recommend the addition of certain materials to hen dung to prevent loss. The N. Y. Station advises, "when the manure is not used when fresh, it is better to mix it with dry earth, muck or plaster." The Mass. State Station says: "The value of hen manure depends not less on the care which is bestowed on its keeping than on the kind of food the fowls consume. * * * A liberal use of plaster, kieserite or of good loam is highly recommendable for the absorption of ammonia. * * * A sandy soil is of little use as an absorbant."

To test the effect of chemicals upon the preservation of the nitrogen of hen dung, the following experiment was made. The roost droppings from 180 mature (20 months old) laying hens were collected each morning, and the droppings for three nights were treated as follows:—

Without anything being added.
Mixed with 27 pounds kainit.
Mixed with 40 pounds plaster.
Mixed with 24 pounds acid phosphate.
Mixed with 15 pounds kiln dried pine sawdust.
Mixed with 15 pounds sawdust and 54 lbs. kainit.
Mixed with 15 pounds sawdust and 82 lbs. plaster.
Mixed with 15 pounds sawdust and 47 lbs. acid phosphate.

These lots were put in barrels and stored in a room in one of the barns from May, 1903, to November, 1903. They were weighed and sampled in November. The following notes on the mechanical condition were taken at the time of sampling.

Hen manure alone. Mouldy. Ammonia very distinctly coming off. Not very lumpy and broke up pretty easily.

Hen manure and sawdust. About the same as hen manure alone, except a little drier, and broke up a little more readily.

With kainit alone. Quite moist, somewhat sticky. Much like green dung in its mechanical condition.

With kainit and sawdust. Quite good mechanical condition.

With plaster. Quite dry, but lumpy.

With plaster and sawdust. Dry and hard lumps of plaster.

With acid phosphate. Rather wet and sticky.

With acid phosphate and sawdust. Quite good mechanical condition, resembling that mixed with kainit and sawdust.

The addition of the sawdust improved very decidedly the mechanical condition of the dung, particularly in the lots to which acid phosphate and kainit were added. The tendency of the plaster to lump was not much less with the sawdust than without. None of these lots could be readily fined so as to be used in a fertilizer drill, but any of them, and particularly the lots treated with sawdust and acid phosphate or kainit could be well applied with a machine similar to the Kemp manure spreader.

The results of the analyses are given in the table which follows.

THE WEIGHTS AND COMPOSITION OF THE THREE NIGHTS DROPPING OF ONE HUNDRED EIGHTY HENS TREATED WITH DIFFERENT MATERIALS AND STORED FOR SIX MONTHS FROM MAY TO NOVEMBER.

Laboratory number.	The three night's dung of 180 hens mixed with chemicals as below.	Percentage Composition.			Weight of Dung Mixture and Constituents.			
		Nitrogen.	Phosphoric acid.	Potash.	Total weight.	Nitrogen.	Phosphoric acid.	Potash.
		Per cent.	Per cent.	Per cent.	Lbs.	Lbs.	Lbs.	Lbs.
3359	By itself	1.30	1.83	.84	44.5	.58	.81	.38
3356	15 pounds sawdust	.97	1.28	.65	63.5	.62	.81	.41
3355	27 pounds kainit	1.27	.97	3.97	93.0	1.18	.90	3.69
3354	15 pounds sawdust ... 54 pounds kainit.....	1.06	.82	5.89	116.5	1.24	.98	6.86
3357	40 pounds plaster.	1.07	.97	.41	91.0	.97	.88	.37
3350	15 pounds sawdust ... 82 pounds plaster.....	1.03	.84	.37	124.5	1.28	1.04	.45
3361	24 pounds acid phosphate	1.52	6.41	.41	78.0	1.19	5.00	.32
3360	15 pounds sawdust ... 47 pounds acid phos..	1.21	8.22	.32	107.0	1.30	8.80	.34

The three nights' droppings carried about 1.25 pounds of nitrogen. From the dung stored by itself or with sawdust more than half of this had escaped during the summer. The lot stored with 40 pounds of plaster lost about one-third while the lot stored with 82 pounds of plaster and 15 pounds of sawdust suffered no loss. The lots with kainit and acid phosphate both with and without sawdust retained practically all of the nitrogen. Both because of the danger of loss and its tendency to form into hard lumps, the plaster is less desirable than either of the chemicals tried. The addition of the sawdust materially improved the mechanical condition of the lots so treated.

The night droppings of the 180 hens (equivalent to 540 hens for 1 night) weighed about 45 pounds and carried about 1.25 pounds of nitrogen, .8 pound of phosphoric acid and .4 pound of potash, or expressed in percentages, it carried 2.8 per cent nitrogen, 1.8 per cent phosphoric acid and .9 per cent potash.

According to Storer's estimate the fertilizing constituents of 100 pounds of hen manure would be worth about 30 cents.

These estimates were based on the analysis of the ordinary air dried manure kept without the addition of preservatives. According to the analysis here reported, the fertilizing constituents of 100 pounds of fresh hen manure would be worth about 55 cents, and these can be stored without loss by the addition of a sufficient amount of land plaster, or better, acid phosphate or kainit.

The N. Y. Station (See table on page 200) found the year's night droppings per hen in one pen to be 29 pounds and in another 33 pounds. Based on these trials, the night droppings of the 180 hens gave about 30 pounds per hen per year, which would carry about .8 pound of nitrogen, .5 pound of phosphoric acid and .25 pound of potash, worth at the usual valuation of commercial fertilizers, about 14 cents.

No data upon the weight of hen dung voided when the birds are on the roosts have been collected by this Station nor to the writers' knowledge have any been published. The hens are upon the roosts much less than half of the time. Because of this and that probably less dung is voided when at roost than when taking exercise, the total droppings of a hen for a year may likely be as much as 75 pounds. Even when the floors are covered with sand and this in turn covered with straw, there would likely be considerable mechanical loss in the form of dust and otherwise. The readily decomposable urates would probably break up faster even then in the case of dung stored without chemicals, so that a very considerable part of the nitrogen of day-voided dung is probably lost for agricultural purposes. Hence while the total droppings probably carry more than twice the amounts noted in the preceding paragraph, the fertilizing constituents actually conserved from the day droppings to be used on the land are probably not more than one-half of those contained in the night droppings.

Hen manure should be applied to the land in comparatively small quantities as it carries much more plant food than ordinary farm manures. Because of the high availibility of its nitrogen, it is used by gardeners as dressing for strawberry beds and similar crops. It also has been long used as an excitant for Indian corn, to be sure that the crop shall be well started. For these uses as an excitant, Storer makes the following recommendations: "An approved method of procedure is to mix the hen-

manure with an equal bulk of wood ashes—together with some peat or loam, to hinder the escape of ammonia—to throw the mixture into little heaps, and to moisten them by sprinkling with a watering-pot. In this way, the uric acid is made ready to act immediately as a powerful forcing-manure. Hen-manure is apt to be sticky when fresh, and lumpy when dry, and it is not easy to make it fine enough to be sown from a drill. Its lightness (of the dried manure) also hinders it from running freely through the tubes. Hence it is better suited for the gardener and the small-way farmer, who can distribute it by hand, than for field operations. But there can be no question as to its value when properly managed."

By itself, hen dung is a one-sided nitrogenous fertilizer. As usually managed, one-half or more of its nitrogen is lost, so that as ordinarily used it does not carry so great an excess of nitrogen. Because of its excess of nitrogen it will be much more economically used in connection with manures carrying phosphoric acid and potash. As both acid phosphate and kainit prevent the loss of nitrogen, it is possible to use them in connection with sawdust or some other dry material as an absorbant (good dry loam will answer nicely) so as to make a well balanced fertilzer. For example, a mixture of 30 pounds of hen manure, 10 pounds of sawdust, 16 pounds of acid phosphate, and 8 pounds of kainit would carry about 1.25 per cent nitrogen, 4.5 per cent phosphoric acid, and 2 per cent potash, which, used at the rate of 2 tons per acre, would furnish 50 pounds nitrogen, 185 pounds phosphoric acid, and 80 pounds potash.